



GVPM Powertrain Overview

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Powertrain

GVSETS
GROUND VEHICLE SYSTEMS ENGINEERING AND TECHNOLOGY SYMPOSIUM

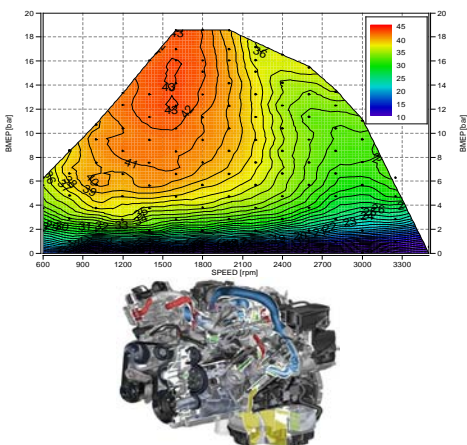
Challenges we have:

- Commercial Off-The Shelf (COTS) engines are not optimized for military applications
- Emissions compatible engines are not compatible with military grade fuels (JP-8, JP-5, DF-2, etc...)
- Availability of power dense and low heat rejecting engines for combat vehicles
- Controls algorithms unique for military platforms targeting global fuel compatibility and fuel efficiency
- Limited transmission technologies specific for the extreme demands and conditions of military vehicles

Solutions we are investigating:

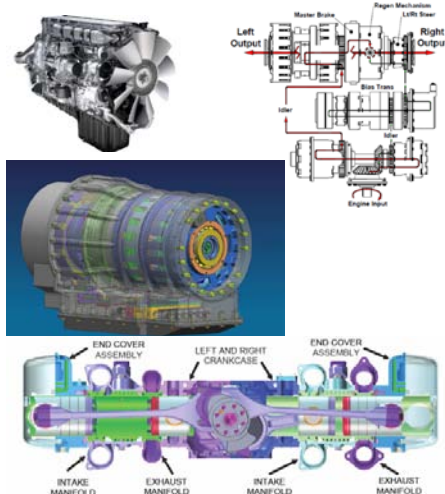
COTS Engine Optimization for JP8 Fuels

- 48% Thermal Efficiency
- 0.6 kW/kW Heat Rejection



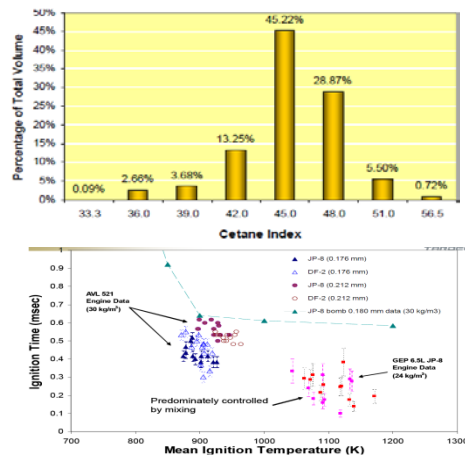
Efficient Powertrain Technologies

- Combat Tracked Vehicles
- Tactical Wheeled Vehicles



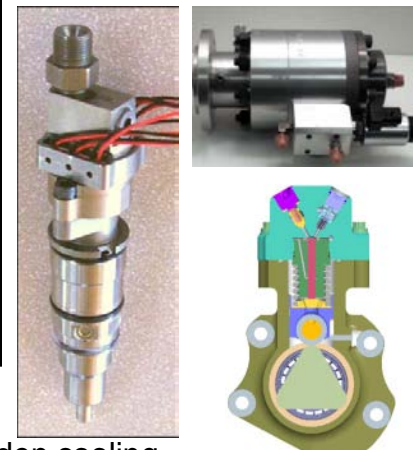
Research on the Ignition and Combustion Variances of JP-8 Fuel

- Fuel Characterizations
- Controls Algorithms



Ultra High Pressure JP-8 Fuel Injection R&D

- Improve engine efficiency
- Injector durability on low lubricity fuels



Where we need your help:

- Military fuel compatibility, fuel efficiency, electrical power generation, high efficiency low thermal burden cooling.
- High power density low heat rejection engine designs, higher temp/low friction materials, improved cooling, efficient accessory drives, advanced controls algorithms.
- Improved torque capacity, better speed/load matching, reduced thermal loading, and improved control strategy for automatic transmission applications.

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Powertrain Projects Current & Future

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Propulsion Technology

High Output Combat Vehicle Powertrain Development:

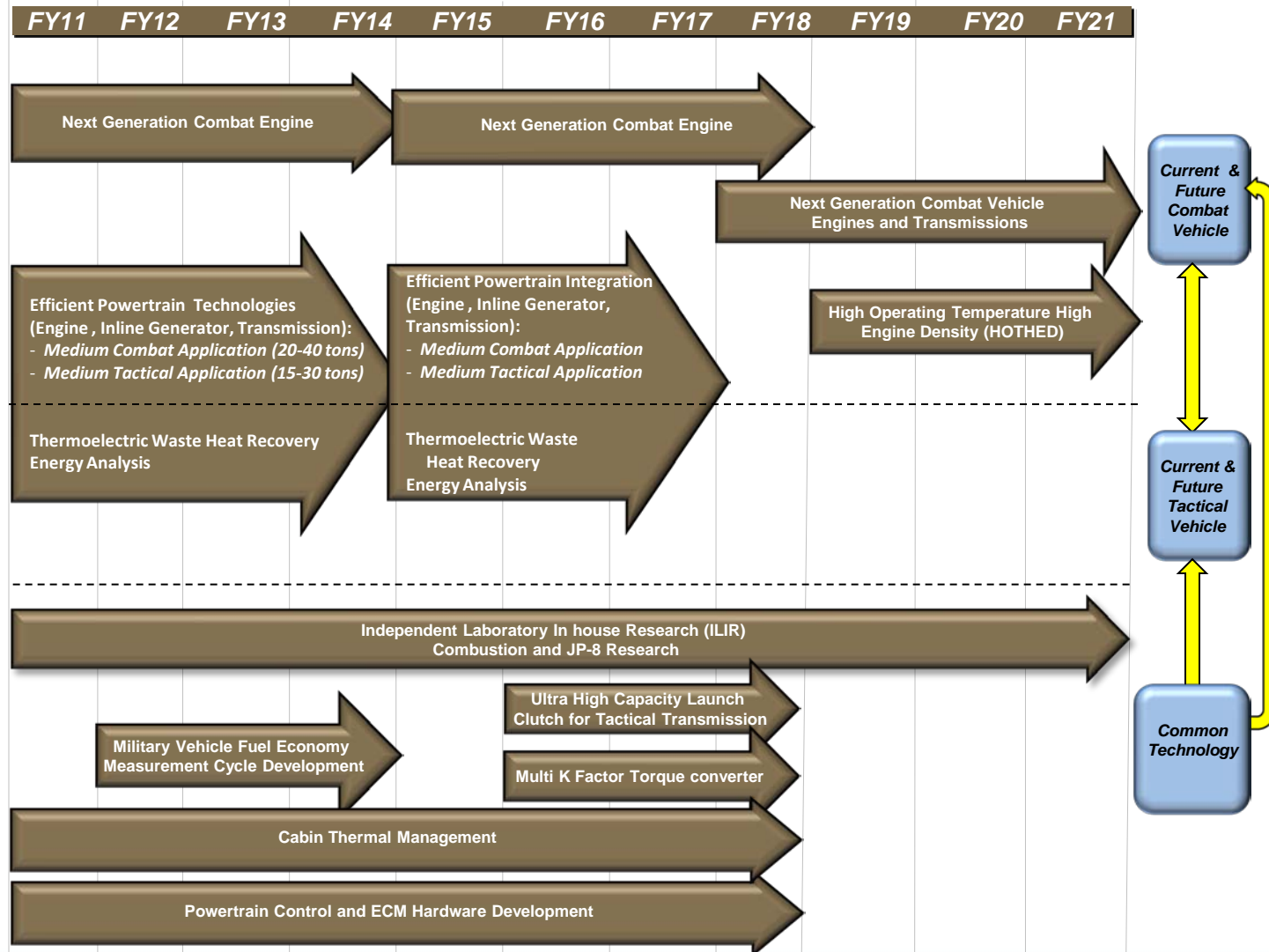
- Advanced Engine Cycle Demo
- Increased Power Density
- Enable Lighter Weight Structures
- Decreased Heat Rejection
- Efficient Binary-Logic Transmission
- Quiet, efficient on-board electrical power generation
- Engine controls adapt engine for variations in heavy fuels
- Efficient, Integrated power pack

Militarizing Commercial Diesel Engines and Transmissions for Tactical Vehicles:

- Efficient, Integrated power pack
- Increased Power Density
- Quiet, efficient on-board electrical power generation
- Improved Fuel Efficiency
- Thermoelectric Waste Heat Recovery

Common Technology Development for Military Vehicles:

- Diesel Cold-start Research
- Common military vehicle drive cycle for fuel economy measurement
- High Efficiency Power transfer devices for military vehicle transmissions
- Cabin Thermal Management
- Militarized Power train Control Module and strategies devices for military vehicle transmissions

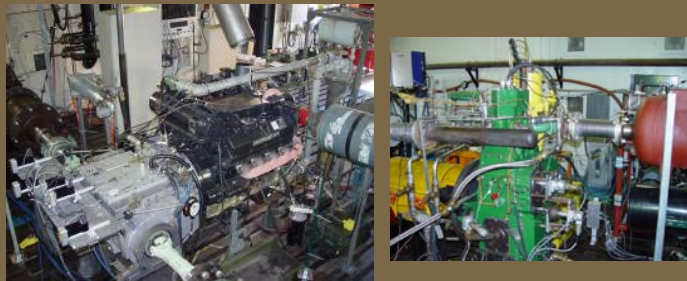


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Laboratory Capability Current & Future

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Current Capability



Propulsion Laboratory

9 Test Cells which include:

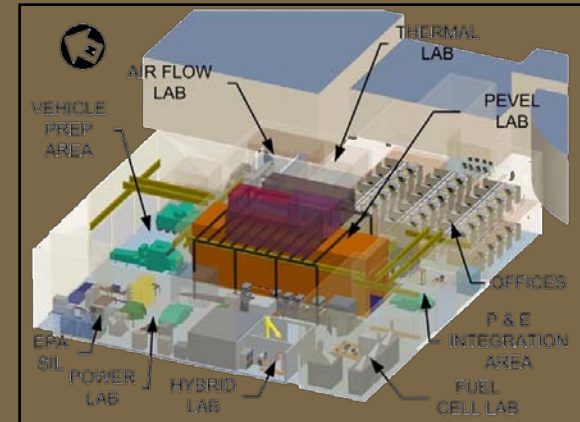
- 6 "engine" test cells used for performance, endurance, transmission or drive train testing
- 2 vehicle test cells designed for steady-state tests to 44,000 ft-lbs per side as well as transient tests and a Power & Inertia Simulator (PAISI)
- 1 vehicle test cell designed for wind speeds up to 20mph in eight possible directions, two 2500 hp dynamometers, 160F ambient temps

GSPEL

Ground Systems Power
and Energy Laboratories

**Powertrain
Roadmap**

Future Capability



P&E Vehicle Environmental Laboratory

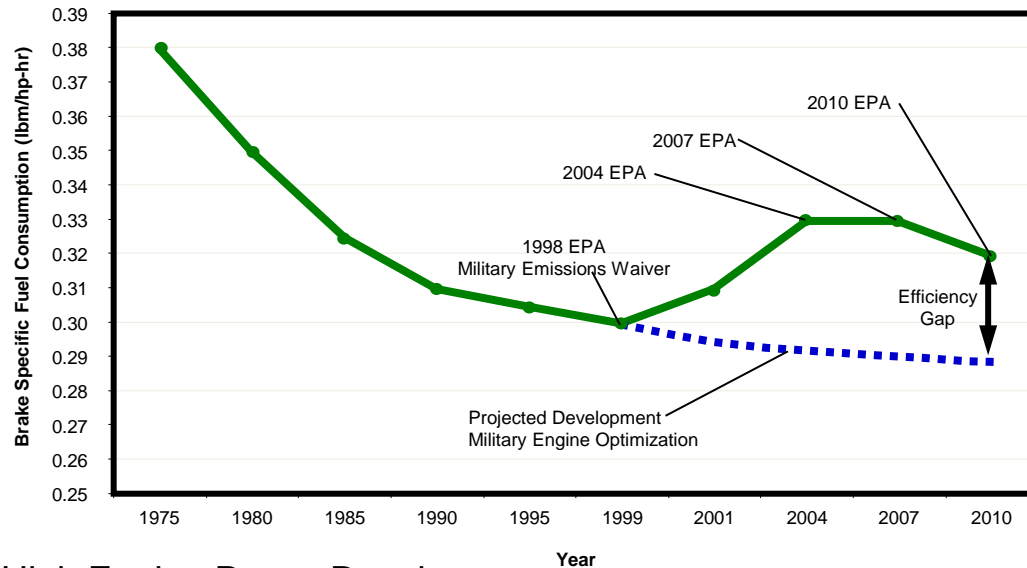
New Vehicle Environmental Lab:

- 12 AC Dynamometers (2 for BFVS class combat vehicle and 10 for all tactical/wheeled vehicle torque/speed ratings)
- Environmental capability from -60F to +160F with variable wind, solar (desert) and humidity (global) control
- Transient cycle (mission profile) test capability for repeatable / controlled condition performance characterization, field failure root cause analysis and modeling and simulation validation data

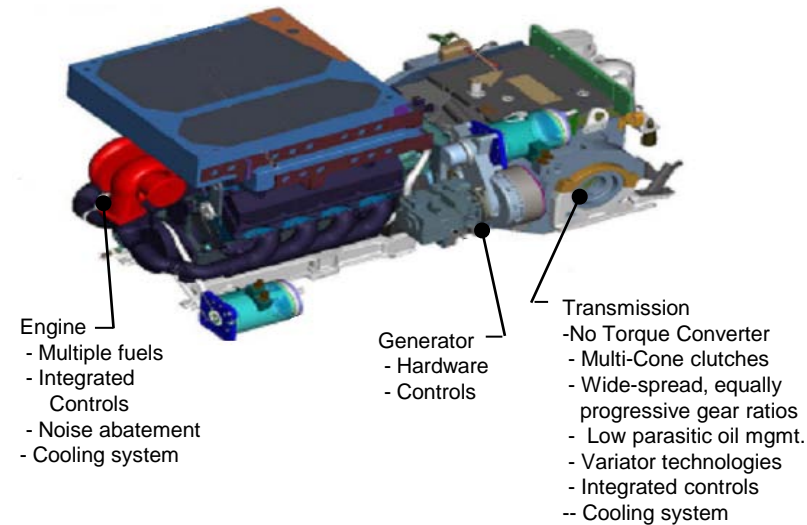
Advanced Powertrain Technologies

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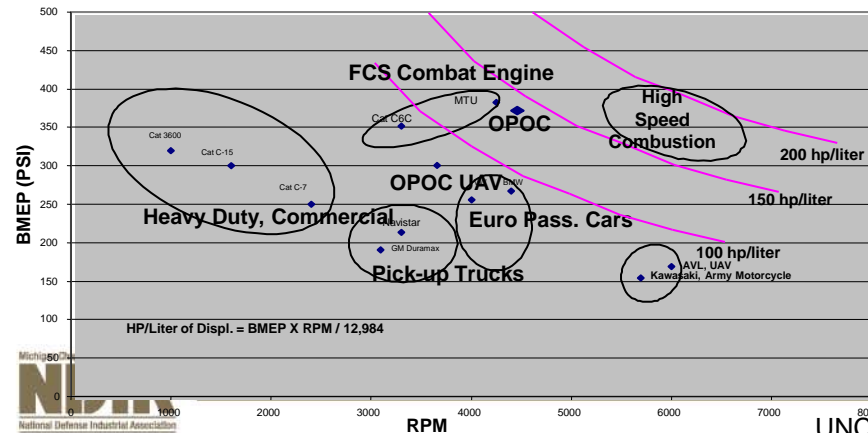
Commercial Heavy Duty Engine Manufacturers have Diverged from Military Engine Demands



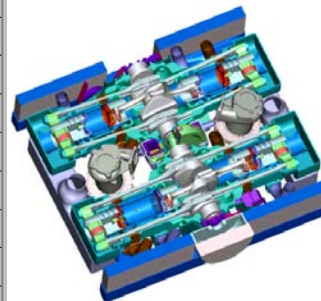
Powertrain Integration and Optimization
> 6 hp/ft³



High Engine Power Density



Next Generation
Combat Engine



Binary Logic
Transmissions
> 90% η

